

SN 09/298,297

Docket No. S-91,723

In Response to Office Action dated November 15, 2005

REMARKS

Applicant appreciates the courtesy shown by the Office, as evidenced by the Office Action mailed on November 11, 2005. In that Office Action, the Examiner objected to Claims 27 and 29, and rejected Claims 1-8, 10-23, 25, 26, 28, and 30. Claims 9 and 24 have been previously canceled, and Claims 1, 9, 15, 18, 22, and 24 are canceled in the present amendment, without prejudice. As such, Claims 1-6, 8, 10-14, 16, 17, 19-23, and 25-30 remain in the case with none of the claims being allowed.

The November 11 Office Action has been carefully considered. After such consideration, Claims 1, 2, 6, 8, 10, 12, 13, 14, 16, 17, 19-21, 23, and 30 have been amended. Applicant respectfully requests reconsideration of the application in light of the accompanying amendment and remarks presented herein.

Rejections under 35 U.S.C. §112, second paragraph

Claims 1, 6-8, 10 -14, 19 -23, 25, 26, 28, and 30 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner states that independent Claims 1 (from which claims 6 - 8 and 10 -13 depend) and 14 (from which Claims 19 23, 25, 26, and 30 depend) recite a "donor layer" and an "acceptor layer," and that this limitation renders the scope of the aforementioned claims vague and indefinite because it is unclear what group/genus of materials is encompassed by the terms "donor layer" and "acceptor layer" in the context of the invention.

Applicant submits that, as stated on page 2, lines 12-5, of the specification, the present invention relates to "...generally to nonlinear optical materials and, more particularly, to the preparation of thin films of layered supramolecular materials having individual molecular layers which exhibit ultrafast electron and/or energy transfer in a chosen direction (emphasis added)." Applicant further submits that one skilled in the art would readily understand that such electron or energy transfer would occur by the movement or transfer of electrons or energy from donor layers to acceptor layers.

Accordingly, Claims 1 and 14 have each been amended to recite the limitations that the donor layer comprise at least one of an electron donor and an energy donor and the acceptor layer comprise at least one of an electron acceptor and an energy acceptor.

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Regarding Claims 6-8 and 28, the Examiner states that these claims require, in part, inserting at least one transparent spacer layer (TSL) between neighboring donor and acceptor layers, but independent Claim 1, from which Claims 6-8 and 28 depend, requires depositing the donor layer directly onto a substrate consisting of non-conductive glass, depositing a NLO material directly onto the donor layer, and depositing an acceptor layer directly onto the NLO material. The Examiner further states that the sequence of layers required by Claims 6-8 and 28 is unclear in the context of Claim 1 which, in effect, requires the donor layer and the acceptor layer to be separated by only an NLO material layer (i.e., not a TSL).

Applicant submits that Claim 6 has been amended to recite the steps of depositing at least one transparent spacer layer on the acceptor layer, and depositing a second donor layer on the at least one transparent layer. Figure 1 and page 9, lines 14-16 of the specification provide support for the amendment.

Regarding Claims 19-21, the Examiner states that these claims require, in part, the further step of depositing a nonlinear optical (NLO) layer onto the donor layer and depositing a TSL layer between the NLO layer and the acceptor layer, but independent Claim 14, from which Claims 19-21 depend, requires depositing the donor layer directly onto a substrate consisting on non-conductive glass, depositing the transparent spacer layer directly onto the donor layer, and depositing the acceptor layer onto the TSL. The Examiner further states that the sequence of layers required by Claims 19-21 is unclear in the context of Claim 14, which requires that the TSL be deposited directly on the donor layer.

Applicant submits that Claim 19 has been amended to recite the steps of depositing a layer of nonlinear optical material onto the transparent spacer layer, and depositing a second transparent spacer layer on the layer of nonlinear optical material such that the second transparent spacer layer is disposed between the nonlinear optical material layer and the acceptor material. Support for the amendment is found in Figure 3 of the application.

Applicant submits that by so amending Claims 1, 6, 14, and 19, the rejections of Claims 1, 6-8, 10-14, 19-23, 25, 26, 28, and 30 under 35 U.S.C. §112, second paragraph, are successfully overcome.

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Rejections under 35 U.S.C. §112, first paragraph

Claims 1-8, 10-23, 25, 26, and 30 are rejected under 35 U.S.C. §112, first paragraph, for lack of enablement. The Examiner states that the specification does not reasonably provide enablement for self-assembling the extremely broad genres of "donor layers", acceptor layers", "non-linear optical material layers", and "transparent spacer layers" into superlattices in order to achieve charge and energy transfer in a controlled direction.

Applicant submits that, as stated in MPEP 2164.08, claims are not to be rejected under 35 U.S.C. §112 as broader than the enabling disclosure for non-inclusion of limitations dealing with factors that must be assumed to be within the level of ordinary skill in the art; the claims need not recite such factors where one of ordinary skill in the art to whom the specification and claims are directed would consider them obvious.

The Examiner states that the specification does not describe or disclose what other individual materials could or should be used for each of the donor, acceptor, nonlinear optical material, and transparent spacer layers.

Regarding the donor and acceptor layers, Claims 1 and 14, as previously presented, have each been amended to recite the limitations that the donor layer comprise at least one of an electron donor and an energy donor and the acceptor layer comprise at least one of an electron acceptor and an energy acceptor. Applicant submits that, rather than being limited to "very specific" materials, as claimed by the Examiner, one skilled in the art would readily and reasonably recognize and identify those materials that may serve as electron or energy donors and acceptors without any undue experimentation. Applicant further submits that knowledge of such donors and acceptors is within the level of ordinary skill in the art, as evidenced by the Examiner's earlier identification of donor and acceptor layers in references cited against the instant application in the Office Action dated December 6, 2004.

Applicant also submits that, in addition to the "very specific materials" cited by the Examiner, the specification includes additional candidate materials. On page 7, lines 27-30, the specification states: "The donor and acceptor layers may include conjugated polymers, fullerenes, porphyrins and phthalocyanines, and other molecular dyes chosen such that photoinduced charge transfer is achieved between the donor/acceptor pair."

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Regarding the nonlinear optical material, Applicant submits that Claims 1, 10, 12, 13, 19-21, and 30 have each been amended to recite the limitation that the nonlinear optical material is a "nonlinear optical chromophore material (emphasis added)." Support for the amendment is found on page 9, lines 11-12, of the specification. Applicant submits that those of ordinary skill in the art would reasonably recognize and identify candidate nonlinear chromophore materials without any undue experimentation. As evidenced by the Examiner's earlier identification of donor and acceptor layers in references cited against the instant application in the Office Action dated December 6, 2004, knowledge of such nonlinear chromophore materials is within the level of ordinary skill in the art.

Regarding the transparent layers, Applicant submits that Claims 6 and 14 have each been amended to recite the limitation that the transparent spacer layer comprises "at least one substantially inert polyelectrolyte." Support for the amendment is found on page 8, lines 24-25, of the specification. Applicant submits that those of ordinary skill in the art would reasonably recognize and identify candidate inert polyelectrolyte materials for use as a transparent spacer layer without any undue experimentation. Knowledge of such transparent layers and their compositions is within the level of ordinary skill in the art, as evidenced by the Examiner's earlier identification of such "transparent spacer layers" in references cited against the instant application in Office Actions dated August 25, 2005, and December 6, 2004.

The Examiner states that the specification discloses no deposition methods or conditions that "could or should be used to deposit hypothetical donor layers, acceptor layers, NLO material layers, and TSLs other than the specific materials disclosed by the applicant in order to produce the claimed superlattice."

Applicant submits that the specification does indeed disclose a general method (page 9, lines 9-16) for self-assembly, as well as a specific example (pages 11, line 22, to page 12, line 5) of self-assembly that would be understood by those of ordinary skill in the art and readily adapted without undue experimentation.

The Examiner cites McBranch ("Supramolecular Photoinduced Charge Transfer Materials for Nonlinear Optics") as teaching that self-assembly is "synthetically difficult" and "the synthesis of charge transfer materials by self-assembling various materials into

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a superlattice (i.e., a process analogous to the claimed method) is synthetically difficult and will not work unless the proper materials are utilized."

A declaration under 37 CFR §1.132 by the Applicant, explaining the comments made in the above-referenced article that were cited by the Examiner, is submitted herewith as Appendix A.

Applicant submits that the comments made by the reference were made in reference to covalent self-assembly. See page 206, column 2, lines 7-25, of the reference. Applicant further submits that the reference, on page 206, column 2, lines 15-16, goes on to state that "(t)hese difficulties have been largely surmounted in recent work..." Applicant submits that, because these difficulties had been "largely surmounted" by the publication date (1998) of the reference, covalent self-assembly techniques are within the current skill in the art and can therefore be practiced by one of ordinary skill in the art without undue experimentation.

Applicant submits that the present invention utilizes ionic self-assembly. See page 9, lines 12-16, of the specification. Contrary to the Examiner's assertion, McBranch (who is also the Applicant), on page 206, column 2, does not teach that ionic self-assembly is difficult, but instead states: "Ionic self-assembly has proven to be a versatile and simple technique for rapidly constructing multilayer solids of arbitrary thickness (emphasis added)(Applicant repeats this statement on page 5, lines 7-9, of the specification)." Applicant therefore submits that, because ionic self-assembly was regarded as "versatile and simple technique" at the date of publication of the reference, ionic self-assembly is within the current skill in the art and may be easily adapted by one of ordinary skill in the art to deposit the layers of the claimed structures without undue experimentation.

Applicant further submits that knowledge of self-assembly techniques is within the level of ordinary skill in the art, as evidenced by the Examiner's earlier identification of such techniques in references cited against the instant application in the Office Action dated December 6, 2004.

Applicant therefore submits that the disclosure is commensurate with the scope of the claims and that the rejection of Claims 1-8, 10-23, 25, 26, and 30 under 35 U.S.C. §112, first paragraph, is successfully overcome.

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Rejection under 35 U.S.C. §102

Claims 14 and 15 are rejected under 35 U.S.C. §102(b) as being anticipated by Schrepp et al. (U.S. Patent 5,294,402).

Claim 14 has been amended to recite the limitations that the donor and acceptor layers are selected from the group consisting of conjugated polymers, fullerenes, porphyrins, and phthalocyanines, wherein the fullerenes include functionalized derivatives of C₆₀ having ionic groups such that the fullerenes are rendered water-soluble. Claim 15 has been canceled, without prejudice, rendering the rejection of the claim moot.

In order to anticipate under §102, a reference must teach each and every aspect of the claimed invention. Accordingly, Applicant submits that Schrepp et al. do not teach all of the elements of Claim 14, as amended. The reference does not teach either a donor or acceptor layer consisting of a functionalized water-soluble fullerene.

Because Schrepp et al. do not teach all of the limitations of amended Claim 14, the rejection of the claim under 35 U.S.C. §102(b) as being anticipated by the reference is successfully overcome.

Rejection under 35 U.S.C. §103

Claims 16, 22, 23, 25, and 26 are rejected under 35 U.S.C. §103(a) as being unpatentable over Schrepp et al. in view of Roberts et al. (U.S. H2046 H).

As presented above, Claim 14, from which Claims 16, 22, 23, 25, and 26 depend, has been amended to recite the limitations that the donor and acceptor layers are selected from the group consisting of conjugated polymers, fullerenes, porphyrins, and phthalocyanines, wherein the fullerenes include functionalized derivatives of C₆₀ having ionic groups such that the fullerenes are rendered water-soluble.

Applicant submits that, in order to establish a *prima facie* case of obviousness, the combination of references cited by the Examiner must either teach or suggest all of the limitations of the claimed invention. As previously presented, Schrepp et al. neither teaches nor suggests all of the limitations of amended Claim 14 and the claims dependent thereon. Applicant further submits that Roberts et al. as well neither teaches nor suggests the limitations of these claims. Therefore, the rejection of Claims 16, 22, 23, 25, and 26 under 35 U.S.C. §103(a) as being unpatentable over Schrepp et al. in view of Roberts et al. is successfully overcome.

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In light of the amendment and remarks presented herein, Applicant submits that the case is in condition for immediate allowance and respectfully requests such action. If, however, any issues remain unresolved, the Examiner is invited to telephone the Applicant's counsel at the number provided below.

Respectfully submitted,

Date: January 30, 2006


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